Tennessee Valley Authority, Post Office Box 2000, Spring City, Tennessee 37381

October 28, 2016

10 CFR 50.73

ATTN: Document Control Desk
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555-0001

Watts Bar Nuclear Plant, Unit 2
Facility Operating License No. NPF-96
NRC Docket No. 50-391

Subject: **Licensee Event Report 391/2016-008-00, Reactor Trip Resulting from Failure of 2B Main Bank Transformer**

This submittal provides Licensee Event Report (LER) 391/2016-008-00. This LER provides details concerning a recent event where the failure of the 2B Main Bank Transformer resulted in a fire and a reactor trip. This report is being submitted in accordance with 10 CFR 50.73(a)(2)(iv)(A).

There are no regulatory commitments contained in this letter. Please direct any questions concerning this matter to Gordon Arent, WBN Licensing Director, at (423) 365-2004.

Respectfully,

for P.S.

Paul Simmons
Site Vice President
Watts Bar Nuclear Plant

Enclosure
cc: See Page 2

cc (Enclosure):

NRC Regional Administrator - Region II
NRC Senior Resident Inspector - Watts Bar Nuclear Plant

NRC FORM 366 (11-2015) U.S. NUCLEAR REGULATORY COMMISSION

APPROVED BY OMB: NO. 3150-0104 EXPIRES: 10/31/2018

Estimated burden per response to comply with this mandatory collection request: 80 hours. Reported lessons learned are incorporated into the licensing process and fed back to industry. Send comments regarding burden estimate to the FOIA, Privacy and Information Collections Branch (T-5 F53), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by internet e-mail to Infocollects.Resource@nrc.gov, and to the Desk Officer, Office of Information and Regulatory Affairs, NEOB-10202, (3150-0104), Office of Management and Budget, Washington, DC 20503. If a means used to impose an information collection does not display a currently valid OMB control number, the NRC may not conduct or sponsor, and a person is not required to respond to, the information collection.

LICENSEE EVENT REPORT (LER)

1. FACILITY NAME	2. DOCKET NUMBER	3. PAGE
Watts Bar Nuclear Plant, Unit 2	05000391	1 OF 5

4. TITLE

Reactor Trip Resulting from Failure of 2B Main Bank Transformer

5. EVENT DATE			6. LER NUMBER			7. REPORT DATE			8. OTHER FACILITIES INVOLVED	
MONTH	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REV NO.	MONTH	DAY	YEAR	FACILITY NAME	DOCKET NUMBER
									N/A	N/A
08	30	2016	2016	- 008	- 00	10	28	2016	FACILITY NAME N/A	DOCKET NUMBER N/A

9. OPERATING MODE	11. THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: *(Check all that apply)*			
1	☐ 20.2201(b)	☐ 20.2203(a)(3)(i)	☐ 50.73(a)(2)(ii)(A)	☐ 50.73(a)(2)(viii)(A)
	☐ 20.2201(d)	☐ 20.2203(a)(3)(ii)	☐ 50.73(a)(2)(ii)(B)	☐ 50.73(a)(2)(viii)(B)
	☐ 20.2203(a)(1)	☐ 20.2203(a)(4)	☐ 50.73(a)(2)(iii)	☐ 50.73(a)(2)(ix)(A)
	☐ 20.2203(a)(2)(i)	☐ 50.36(c)(1)(i)(A)	☒ 50.73(a)(2)(iv)(A)	☐ 50.73(a)(2)(x)
10. POWER LEVEL	☐ 20.2203(a)(2)(ii)	☐ 50.36(c)(1)(ii)(A)	☐ 50.73(a)(2)(v)(A)	☐ 73.71(a)(4)
	☐ 20.2203(a)(2)(iii)	☐ 50.36(c)(2)	☐ 50.73(a)(2)(v)(B)	☐ 73.71(a)(5)
	☐ 20.2203(a)(2)(iv)	☐ 50.46(a)(3)(ii)	☐ 50.73(a)(2)(v)(C)	☐ 73.77(a)(1)
98	☐ 20.2203(a)(2)(v)	☐ 50.73(a)(2)(i)(A)	☐ 50.73(a)(2)(v)(D)	☐ 73.77(a)(2)(i)
	☐ 20.2203(a)(2)(vi)	☐ 50.73(a)(2)(i)(B)	☐ 50.73(a)(2)(vii)	☐ 73.77(a)(2)(ii)
		☐ 50.73(a)(2)(i)(C)	☐ OTHER Specify in Abstract below or in NRC Form 366A	

12. LICENSEE CONTACT FOR THIS LER

LICENSEE CONTACT	TELEPHONE NUMBER *(Include Area Code)*
Dean Baker, Licensing Engineer	423-452-4589

13. COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT

CAUSE	SYSTEM	COMPONENT	MANU-FACTURER	REPORTABLE TO EPIX	CAUSE	SYSTEM	COMPONENT	MANU-FACTURER	REPORTABLE TO EPIX
X	EL	XFMR	GE	Y					

14. SUPPLEMENTAL REPORT EXPECTED	15. EXPECTED SUBMISSION DATE	MONTH	DAY	YEAR
☐ YES *(If yes, complete 15. EXPECTED SUBMISSION DATE)* ☒ NO				

ABSTRACT *(Limit to 1400 spaces, i.e., approximately 15 single-spaced typewritten lines)*

On August 30, 2016, at 2110 Eastern Daylight Time (EDT), the Watts Bar Nuclear Plant (WBN) Unit 2 reactor tripped on turbine trip as a result of an electrical fault. All control rods fully inserted and no safety or relief valves lifted. The Auxiliary Feedwater system actuated as designed.

The electrical fault was caused by an internal fault on the low voltage side of the 2B Main Bank Transformer (MBT) which resulted in a fire. The electrical fault was cleared by the 2B MBT sudden pressure and phase differential relays. Automatic fire suppression operated as expected and a fire fighting team was established by the fire brigade with assistance from local fire departments. The fire was extinguished at 2230 EDT.

The failed 2B MBT was removed from the plant and the spare MBT was connected in its place. The unit was returned to power and replacement transformers are being procured by the Tennessee Valley Authority for long term reliability.

NRC FORM 366A (11-2015) U.S. NUCLEAR REGULATORY COMMISSION

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LICENSEE EVENT REPORT (LER) CONTINUATION SHEET

1. FACILITY NAME	2. DOCKET NUMBER	3. LER NUMBER		
		YEAR	SEQUENTIAL NUMBER	REV NO.
Watts Bar Nuclear Plant, Unit 2	05000391	2016	- 008	- 00

NARRATIVE

I. PLANT OPERATING CONDITIONS BEFORE THE EVENT

Watts Bar Nuclear Plant (WBN) Unit 2 was in Mode 1 at 98 percent Rated Thermal Power (RTP) .

II. DESCRIPTION OF EVENT

A. Event Summary

On August 30, 2016, at 2110 Eastern Daylight Time (EDT), the WBN Unit 2 reactor tripped on turbine trip as a result of an electrical fault. All control rods fully inserted and no safety or relief valves lifted. The Auxiliary Feedwater (AFW) system {EIIS:BA} actuated as designed.

The electrical fault was caused by an internal fault on the low voltage side of the 2B Main Bank Transformer (MBT){EIIS:XFMR} which resulted in a fire. The MBTs are part of the main generator output power system {EIIS:EL}. The electrical fault was cleared by the 2B MBT sudden pressure and phase differential relays. Automatic fire suppression for the 2B MBT operated as expected and a fire fighting team was established by the fire brigade with assistance from local fire departments. The fire was extinguished at 2230 EDT.

This event is being reported to the Nuclear Regulatory Commission (NRC) under 10 CFR 50.73(a)(2)(iv)(A) as a safety system actuation.

B. Inoperable Structures, Components, or Systems that Contributed to the Event

No inoperable systems contributed to the event.

C. Dates and Approximate Times of Occurrences

Date	Time (EDT)	Event
8/30/16	2110	Unit 2 Reactor trip due to Turbine Trip (electrical fault). Concurrently receive fire alarms and fire pumps start.
	2113	2B MBT reported engulfed in flames. Operations transitions to 2-ES-01, Reactor Trip Response.
	2120	Notification of Unusual Event (NOUE) declared.
	2122	Offsite assistance requested for fire fighting
	2130	State of Tennessee Notified
	2149	NRC notified of NOUE. Operations transitions to 2-GO-5, Unit Shutdown from 30 percent Reactor Power to Hot Standby.
	2230	Fire extinguished
	2314	Completed reactor shutdown. Unit stabilized in Mode 3.
	2342	Exit from NOUE

D. Manufacturer and Model Number of Components that Failed During the Event

The 2B MBT is a General Electric Single Phase Power Transformer rated for 22.5kV/500kV service, Serial Number M-100714.

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NARRATIVE

E. Other Systems or Secondary Functions Affected

No other safety systems were affected by this event.

F. Method of discovery of each Component or System Failure or Procedural Error

The failure of the 2B MBT became readily apparent based on field observation and protective relay actuation.

G. Failure Mode and Effect of Each Failed Component

The 2B MBT failed as a result of an internal fault on the low voltage side of the transformer. No indications of transformer degradation (e.g. temperatures, bushing oil levels, dissolved gas levels) were present prior to the failure.

H. Operator Actions

Following the reactor trip, operations moved promptly through the emergency procedures and stabilized the plant. A senior reactor operator was established as the incident commander and directed the response to the transformer fire.

I. Automatically and Manually Initiated Safety System Responses

All safety systems operated as expected. The reactor protection system and AFW system automatically actuated as designed.

III. CAUSE OF THE EVENT

A. The cause of each component or system failure or personnel error, if known.

This event was the result of an internal fault on the low voltage side of a large power transformer. No indications of transformer degradation (e.g. temperatures, bushing oil levels, dissolved gas levels) were present prior to the failure.

A root cause evaluation (RCE) is in progress. The draft RCE indicates that the most likely cause was inadequate clearance between the X3 bus and the X1 flex braid as a result of either a latent design issue or initial installation error.

B. The cause(s) and circumstances for each human performance related root cause.

No human performance root cause is applicable to this event.

IV. ANALYSIS OF THE EVENT

Under normal operating conditions, the main generators supply electrical power through isolated-phase buses to three single phase main step-up transformers, which provide power to the switchyard and to serve on-site power loads through the unit station service transformers. The MBTs are

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Watts Bar Nuclear Plant, Unit 2	05000391	2016	- 008	- 00

NARRATIVE

provided with a deluge system in the event of their failure. The fault on the 2B MBT resulted in a turbine trip and resultant reactor trip, and concurrently resulted in a transformer fire with actuation of the associated transformer's deluge system. With the exception of the fire, the trip and shutdown of Unit 2 were uncomplicated, with all safety related equipment operating as expected.

V. ASSESSMENT OF SAFETY CONSEQUENCES

The loss of the 2B MBT led to a reactor trip and a fire in the plant switchyard. The response to the Unit trip was uncomplicated with the exception of the transformer fire. The fire was extinguished in a little over one hour with the assistance of local firefighters. The probabilistic risk analysis of this event indicates that while a moderate increase in the potential for a Loss of Offsite Power (LOOP) occurred, the core damage increase did not significantly exceed annual baseline values.

A. Availability of systems or components that could have performed the same function as the components and systems that failed during the event

No safety systems failed during this event.

B. For events that occurred when the reactor was shut down, availability of systems or components needed to shutdown the reactor and maintain safe shutdown conditions, remove residual heat, control the release of radioactive material, or mitigate the consequences of an accident

Not applicable.

C. For failure that rendered a train of a safety system inoperable, an estimate of the elapsed time from the discovery of the failure until the train was returned to service

Not applicable.

VI. CORRECTIVE ACTIONS

This event was entered into the Tennessee Valley Authority (TVA) Corrective Action Program and is being tracked under condition report (CR) 1208823.

A. Immediate Corrective Actions

The WBN spare MBT was prepared and set up to replace the failed 2B MBT. A root cause evaluation was initiated.

B. Corrective Actions to Prevent Recurrence or to Reduce Probability of Similar Events Occurring in the Future

Internal inspections of the 2A, 2C and Spare MBT were performed to confirm adequate clearances were present in these transformers. TVA is in the process of procuring replacement transformers for WBN for long term reliability. As a result of a subsequent event documented in CR 1225886, insulating spacers have been installed between certain flex braids and bus work on the Unit 2 MBTs where clearances were minimal.

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NARRATIVE

VII. PREVIOUS SIMILAR EVENTS AT THE SAME SITE

No previous large transformer failures have occurred at the Watts Bar site.

VIII. ADDITIONAL INFORMATION

If the final root cause for this event is significantly different than what is described in this LER, the LER will be supplemented.

IX. COMMITMENTS

None.